SAFETY PLAN AT RAY MINES DIVISION KENNECOTT COPPER CORP., RAY, ARIZ.

By Allen D. Look and M. L. Williams

* * * * * * * * * * **Information Circular 7772**

UNITED STATES DEPARTMENT OF THE INTERIOR
Fred A. Seaton, Secretary
BUREAU OF MINES
Marling J. Ankeny, Director

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Allen D. Look[1/] and M. L. Williams[2/]

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INTRODUCTION AND SUMMARY

The safety program at the Ray and Hayden, Ariz., plants of Kennecott Copper Corp. has undergone many changes during the more than 40 years of operations. The accident-prevention program now in effect at the Ray and Hayden plants was the outgrowth of a supervisors' training program about 3 years ago. Its evident success to date can be attributed to the wholehearted support of management; the interest, initiative, and planning by the department heads and supervisor; and the health response of every employee. (See fig. 1 for view of opencut mining operations.)

The program is based on a plan of action that was devised only after detailed study, planning, research, and discussion by management, department heads and supervisors, and in its present form is referred to as the Master Safety Plan.

The Ray Mines Division, Kennecott Copper Corp., comprises operations at Hayden and Ray, Ariz. The Hayden operations consist of a 15,000-ton-per-day copper concentrator and incidental shops. Copper ores (about 1-percent grade) are transported from the opencut mine operations at Ray, Ariz., over 25 miles of company-owned standard-gage railroad. Also a part of the Ray operations are a copper-leaching plant, primary crushing plant, railroad, truck and general shops, warehouses, and general offices.

ACKNOWLEDGMENT

The authors acknowledge the cooperation of personnel of the Ray Mines Division, Kennecott Copper Corp., in providing information and other assistance which made this circular possible.

All photographs were provided through the courtesy of the Kennecott Copper Corp.

FORMATION OF THE MASTER SAFETY PLAN

Before the safety plan was placed in active operation an organized study was made of all factors that could possibly affect its purposes.

This study was conducted along the following outline:

1. Communicative system:
    a. Frequency of plant mail deliveries.
    b. Frequency and regularity of departmental and supervisory meetings.
    c. Adequacy and frequency of employee - supervisor contacts.
2. Work-order system as it applies to safety:
    a. Use of work orders.
    b. Handling of safety suggestions.

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Figure 1. - General view of opencut mining operations; Ray, Ariz., in foreground, Sonora, Ariz., in background.

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3. Record keeping:

   a. Safety records. (Medical
   b. Cost records as applied to safety - (Material damage
   c. Individual employee records. (Compensation

4. Company policy:

   a. Attitude toward safety.
   b. Rules and regulations.

5. Union participation:

   a. Unions represented on plant safety committees.

6. Safety support for supervisors:

   a. Safety training.

7. Induction procedure:

   a. Employee safety rules book.
   b. Preemployment safety indoctrination:

      (1) General by safety engineer.
      (2) Specific by foreman.
      (3) Followup by safety engineer in 1 month.

The Master Safety Plan is a flexible instrument designed to permit changes in the operation of the plan as the need arises without affecting the aim of the plan or the major parts of the program.

The operation of the plan is designed to develop a sense of safety awareness in the minds of department heads and supervisors and eventually, through these persons, the safety idea will gravitate down to the employee level.

TRAINING

The initial safety-training course for foremen was conducted by the conference method during the regular working hours. Each group was limited to a maximum of 15 men and met for 2 hours on alternate days, Monday through Saturday, thus requiring 4 weeks for each 15-man group to complete this phase of the plan. From April 20, 1953, to June 12, 1953, 55 departmental heads and supervisors, including top-level officials, completed the 24-hour course and were awarded certificates. All conferences were conducted by a well-trained staff under personal direction of the personnel coordinator and the supervisor of training. An excellent conference room was provided and was equipped with numerous visual and audiovisual training aids. (See fig. 2.)

Initial Course in Safety Training for Foremen

The subject matter was arranged under 8 major headings spread over the 12 sessions, as follows:

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Figure 2. - Training class in progress.

Figure 3. - On-the-job 5-minute safety talk being given by foreman.

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Class	Subject
1	A survey of accident records. National-State-Mining Industry and Ray Mines Division. (Designed to sell the need for safety concentration.)
2	Accident investigation.
3	Hazards - how to recognize them and guard against them (guards, signs, etc).
4	Protective clothing and its value in safety.
5	Good housekeeping and its role in accident prevention.
6-7	Human factors in safety.
8-9	The foreman's own master safety plan. Designed to help the foreman formulate his plan of safety operations.
10-11	How to give a safety talk - pointers and practice on giving a weekly 5-minute safety talk.
12	General discussion to review progress and answer questions.

Safety training is injected into all supervisors' training conferences, regardless of the nature of the conference. Whenever deemed necessary, additional safety training conferences will be given. At the time of this writing a revision incorporating all changes is being prepared for presentation to supervisors who have not received the course. A refresher course for presentation to all supervisors is also being prepared.

The on-the-job safety training as carried out by the foreman is the only place in the plan where the training phase reaches the employee level. However, the plan is definitely aimed at this point.

Each foreman is required to give the employees under his supervision a 5-minute safety talk at least once each week. (See fig. 3.) He may select his own subject material or he can readily obtain assistance and advice from the safety engineer. To assist the foreman further in planning and conducting his weekly safety talks a growing library of suitable safety talks and various visual-aid equipment such as "Safety Graphs," strip films, and slide projectors are at his disposal. (See appendix A.) As a further aid a "Guide for Preparation of Safety Talks" was prepared. (See appendix B.) For special purposes, members of the Safety Department staff are prepared to assist the foreman at these meetings. The foreman submits a weekly report of safety talks to his department head who in turn submits a composite report to the Plant superintendent of all safety talks by foremen under his jurisdiction. (See appendix C.)

New employees are interviewed by the plant safety engineer and in these interviews the new employee is made aware of the policy of the company toward safety, and he is urged to participate personally in the program through submitting safety suggestions and by talks with his foreman. He is also informed of the types of safety clothing he is required to wear on the job, where he can purchase these items, and why they are required in his work. (See appendix D.) Before the new employee begins his assigned work he is given a safety-instruction talk by his

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foreman. Employees transferred from one department to another are also given safety instruction by their new foreman. One month after starting work each new employee is given followup safety indoctrination by the safety engineer.

PUBLICITY

To maintain the attitude of safety awareness, the aim and progress of the general safety program are publicized through several mediums. Again, effective use is made of various forms of visual aids.

Safety record boards for each department and subdepartment were installed at strategic locations. (See fig. 4.) The boards are provided with racks to hold various printed handouts, such as the weekly safety bulletin, which further publicizes the safety records and achievements of the various departments. Interest in the bulletin boards is maintained by frequent changes in the subject matter.

Employees' families and others in the community are informed of safety matters through the showing of sound films exhibited in the local theaters, schools, and various service clubs.

Two interdepartmental safety contests are being used. The employees are divided into three groups of approximately equal size. When a group works 30 consecutive days without a lost-time industrial disability, each member of the group is mailed two tickets to the local theater with a covering letter from the general manager. An annual contest was started January 1, 1956, in which the same three groups compete. Each group has a par which is its own average frequency for the preceding 3 years. The group that makes the greatest percentage improvement over its own par will be the winner. Employees in the winning group will be given a suitable token award, and with their families, will be guests of the company at a picnic or other gathering. An improved accident record and any other outstanding safety effort made by a department or individual is promptly recognized by management in the form of special awards or congratulatory letters and is publicized in the weekly safety bulletin.

SAFETY STATISTICS

The effectiveness of a safety program is best indicated in the accident record, and a true picture can be obtained only by complete and honest records. In this respect the management of the Ray Mines Division appears determined to present such a true picture. American Standards Association Standard No. Z16.1-1954 is rigidly followed in the interpretation of cases to determine whether they are recordable in statistics for calculating frequency and severity. If a case is not recordable under the standard, but the State Industrial Commission awards compensation, the compensation awarded is still included in the total compensation costs.

Individual accident reports are prepared in detail by the foreman on the job as soon as practicable following the accident. (See appendix E.) From these individual reports, monthly (see appendix F) and annual reports are prepared.

The annual safety report submitted to management is complete and concise. The report presents a true and graphic accounting of the progress of the safety plan and depicts the safety picture from two angles - (1) A comprehensive statistical analysis, and (2) a cost analysis.

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Figure 4. - Safety record competition bulletin board in use at Hayden concentrator.

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INSPECTIONS

Formal inspection tours are made each month at the Ray plant and at the Hayden plant by the respective plant safety committees, and their recommendations are submitted to the supvervisors' committee for action.

Informal inspections and contact trips are made by the safety engineer at frequent intervals, each work area being visited at least once a week and more generally several times a week.

Informal departmental inspections are also made by individual department committee members; that is, the truck shop representative inspects the truck shop; the machine representative inspects the machine shop, etc. Suggestions and recommendations are brought together in the regular monthly meeting of the representatives as members of the Department Safety Committee.

INVESTIGATIONS

Supervisors investigate all accidents involving workmen under their jurisdiction and submit a formal report that details the accident, its cause, responsibility and recommendations. (See appendix E.)

All lost-time or potential lost-time accidents are investigated by the plant safety engineer, assisted by the Plant Safety Committee. The safety engineer submits a formal narrative report with recommendations attached to the supervisor's accident report. All such investigative reports are routed through the superintendent and general manager before becoming part of the permanent records.

SAFETY COMMITTEES

To insure a free flow of safety communications between the employee and management there are three types of committees: The Department Committee, the Supervisors' Committee, and the Plant Safety Committee. The Department Committee is composed of one representative from each unit within the department. The department head serves as permanent chairman, and the plant safety engineer serves as the recording secretary. Except for the chairman and the recording secretary, membership in this committee is changed by staggered 3-month rotation. The Department Committees handle all safety problems within their respective departments unless the necessary action requires the cooperation of another department or an unusually large expenditure, in which case the problem is referred through the chairman's report to the Supervisors' Committee. Meetings are held monthly and a report is submitted. (See appendix G.)

The Supervisors' Committee is a permanent committee made up of representatives of top management, heads of departments, and the safety engineer. In operation this committee reviews suggestions and any matters that cannot be solved on a departmental level and initiates remedial actions when necessary. The committee is also responsible for initiating and administering all safety contests with the aid of the Plant Safety Committees. Periodically the plant safety records and accident analyses are reviewed. Meetings are held monthly and a report prepared to show action taken on safety suggestions. (See appendix H.)

The Plant Safety Committee at the Ray and Hayden plants is composed of one member from each labor organization and the plant safety engineer. These committees conduct monthly formal overall plant-safety inspections at their respective plants

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then discuss their findings and prepare suitable recommendations. The committees also assist in the investigation of all lost-time accidents. The committee members act as judges for the safety contests and aid in the overall administration of the safety program.

CONCLUSIONS

The Safety Program has proved most effective in bringing about a steady reduction in the number of lost-time industrial disabilities from 97 with a frequency of 40.94 in 1952, to 25 and a frequency of 11.71 in 1955. The National Safety Council gave the entire Ray Mines Division the Award of Honor for its safety performance during 1955.

TABLE 1. - Accident frequency and compensation costs, Ray Mines Division, 1952, 1954, and 1955

	1952	1954	1955
Man-hours worked	2,369,416	2,218,994	2,135,375
Number of lost-time accidents..	97	41	25
Frequency rate	40.94	18.47	11.71
Compensation costs	$64,369.38	$47,868.33	$8,779.07

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APPENDIX

A. Guide for Preparation of Safety Talks

I. List ideas

A. Questions to stimulate ideas
1. Do we know any accidents connected with subject?
2. What are the related unsafe conditions?
3. What unsafe acts are related?
4. Do we have any pictures, models, or demonstrations to show?
5. Do we know any interesting story, experience, or joke connected with subject?

B. Other sources of ideas
1. Safety supervisor.
2. Newspaper.
3. Magazine.
4. Safety course material.
5. Safety library.

C. Variety of ideas
1. V - Visual aids.
2. A - Anything you can read.
3. R - Related comparisons.
4. I - I did it.
5. E - Examples.
6. T - Statistics.
7. Y - Humor.

II. Organize these ideas

A. Start off with need to improve.
1. Actual accident.
2. Statistics.
3. Personal experience.

B. End with a bang.
1. Review points made in talk.
2. Tell a story on main theme of talk.
3. Ask for action.

III. Study outline

A. Review main points.
B. Review joke or story to make sure it's down pat.

IV. Rehearse once

A. Rehearse out loud to yourself.
B. To see if you know it.
C. To check time.

V. Notify men of time and place of talk, if possible, to insure full attendance

VI. Assemble men and give talk

VII. Report subject of talk to department head

VIII. Survey needs for subject of next talk

IX. Begin to gather ideas for next talk

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B. Inventory of Safety Aids and Posters

Aim: To make available to all foremen and supervisors a lending library of safety aids and safety posters.

Illustrated safety talks:

1. Why Accident Prevention (2 copies).
2. Shovels, Cranes, Draglines (2 copies).
3. Personal Protective Equipment (2 copies).

Safety graphs:

1. How to Lift.
2. Bench and Stand Grinders.
4. Wearing Goggles (3 copies).
5. Plant Housekeeping.
9. Common Hand Tools
11. Toe Protection.
14. Only a Scratch.
15. Wanted, Safe Workers.
16. Falls.
17. Does Your Accident Show.
18. My Aching Back.

Five-minute safety talks:

Book No. 1 (35 copies)

1. General.
2. Personal Behavior.
3. Personal Protective Equipment.
4. Housekeeping and Sanitation.
5. Fire Protection.
6. Material Handling.
7. Control of Machine Hazards.
8. Working at Elevations.
9. Chemical and Solvent Hazards.
10. Storage of Materials.
11. Miscellaneous.

Book No. 2 (5 copies)

1. General.
2. Personal Behavior.
3. First Aid and Health.
4. Personal Protective Equipment.
5. Housekeeping.
6. Fire.
7. Material Handling and Storage.
8. Falls.
9. Machinery.
10. Chemicals and Solvents.
11. Hand and Power Tools.

Book No. 3 (5 copies)

1. It's Up To Us.
2. Dress for Safety.
3. Keep It Clean.
4. In Case of Accident.
5. Fire.
6. Hand Tools.
7. Portable Power Tools.
8. Job Hints.
9. Take a Tip.
10. On Your Own Time.

NOTE: For each subject listed in the "Five Minute Safety Talk" books, we have several applicable safety posters available.

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C. Departmental Safety Talk Report

Kennecott Copper Corp.
Ray Mines Division
Ray, Ariz.

Department _____ Date _____

The following safety talks were given by the foremen of this department during the week ending Sunday, _____ 195__.

Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present
Foreman	Subject	Men present

Signed _____ _____
(Department Head) (Superintendent)

This report goes to General Manager via above channels and back to Safety Office for file.

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D. Safety Protective Clothing Available

The following may be obtained from the Mine Tool Room:

Item	No. 2 mine	How obtained
Leather gloves		Deferred charge[1/]
Rubber gloves		Do.
Bulldog goggles		Do.
Plastic goggles		Do.
Type "C" green goggles		Do.
Rubber boots (for temporary work)		Do.
Rubber boots (for personal use)		Personal charge[2/]
Leggings		Deferred charge
Safety belts		Do.
Toe guards		Do.
Shin guards		Do.
Respirators		Do.
Lamp belts		Personal charge
Hard hats		Do.
Safety glasses		Deferred charge (for slusher operators)
		Personal charge (to other employees)
Plastic goggles		Deferred charge

The following may be obtained from the Pit Office:

Item	Open pit	How obtained
Rubber gloves		Deferred charge
Leather gloves		Do.
Respirators		Do.
Plastic goggles		Do.
Safety glasses		Personal charge
Hard hats		Do.

The following may be obtained from the Master Mechanics Office:

Item	Mechanical Department	How obtained
Welding goggles		Deferred charge
Plastic goggles		Do.
Welder hoods		Do.
Welders sleeves		Do.
Welders aprons		Do.
Welders gloves		Do.
Leather gloves		Personal charge
Rubber gloves		Do.
Hard hats		Do.

1/ Deferred charge means that items are checked out to employees. If these items are worn out and returned, there is no charge for replacement. If the deferred charge item is not returned upon termination, the price is deducted from the final pay check.

2/ Personal charge means that the item is made available at company cost. Replacement of such items is not furnished but must be purchased just the same as the original item.

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The following may be obtained from the Electrical Shop:

Item	Electrical Department	How obtained
Respirators		Deferred charge
Leather gloves		Do.
Rubber gloves		Do.
Safety belts		Do.
Plastic goggles		Do.
Hard hats		Personal charge
Safety glasses		Do.

The following may be obtained from the Framing Shed:

Item	General surface	How obtained
Respirators		Deferred charge
Rubber gloves		Do.
Plastic goggles		Do.
Hard hats		Personal charge
Snake bite kits		Deferred charge (to be returned when job is finished)

The following may be obtained from the Engineering Office:

Item	Engineering Department	How obtained
Respirators		Deferred charge
Hard hats		Personal charge
Safety glasses		Do.

General Information

Prescription ground glasses can be obtained by having an eye examination by Dr. Karl Hoefest, who is in Ray every Wednesday between the hours of 10:00 a.m. and 5:00 p.m. at the K. of P. Hall. Safety shoes can be purchased at any of the shoe stores in Ray at cost plus 10 percent.

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E. Foreman's Accident Report

Report filled out _____ Date _____

Name _____ P. R. No. _____ Occupation _____

Location of accident _____ First Aid given? _____

Occurred _____ _____ Did injured complete shift? Yes ( ) No ( )
(hour) (date)

Was injured sent to hospital for treatment? Yes ( ) No ( )

Number of days lost _____

Description of accident _____

Witnesses _____

Analysis of Accident

Accident type

( ) Struck by
( ) Struck against
( ) Caught in between
( ) Falls
( ) Lifting
( ) Electric shock
( ) Inhalation
( ) Using hand tools
( ) Machines or equipment
( ) Falling or flying objects
( ) Explosion
( ) Burn
( ) _____

Injury location

( ) Head
( ) Chest
( ) Shoulder
( ) Back
( ) Abdomen
( ) Arm
( ) Hand
( ) Leg
( ) Foot
( ) Eye
( ) Finger
( ) _____

Injury Type

( ) Abrasion (scratches)
( ) Laceration (cuts)
( ) Puncture
( ) Skin irritations
( ) Infection
( ) Fracture
( ) Burns
( ) Eye injury
( ) Sprain, strain
( ) Contusion (bruises)
( ) _____

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Analysis of the Cause

Unsafe acts due to:

( ) Lack of instruction
( ) Lack of concentration
( ) Lack of discipline
( ) Poor judgment
( ) Physical condition
( ) Emotionally upset
( ) Haste
( ) Taking short cut
( ) Unnecessary exposure
( ) Lack of experience

( ) Inadequate or lack of guards
( ) Poor housekeeping
( ) Inadequate protective clothing
( ) Defective tools
( ) Improper layout of building, racks, etc.
( ) Poor light, ventilation, etc.
( ) Defective machines or equipment
( ) Weather conditions
( ) _____

Responsibility

( ) Employee ( ) Foreman ( ) Department head ( ) Safety foreman

( ) Other _____

Rule violation? _____ Rule No. _____

Violated by: _____

What action (will be) (could be) (has been) taken to prevent recurrence:

_____

_____ (Foreman)

_____ (Department head)

_____ (Safety foreman)

_____ (Superintendent)

_____ (General manager)

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F. Monthly Safety Report, by Departments

For Month Ending: June 1956

Kennecott Copper Corp.
Ray Plant of Ray Mines Division

	Pit	Mech.	Surface	Elec.	Eng.	Track	Acct.	Misc.	Ray Elect.	Total
L.t.[1] accidents June										
L.t. accidents to date										
L.t. accidents 1955										
Days lost June										
Days lost to date										
Days lost 1955										
N.l.t.[2] accidents June										
N.l.t. accidents to date										
N.l.t. accidents 1955										
Frequency rate June										
Frequency rate to date										
Frequency rate 1955										
Severity rate June										
Severity rate to date										
Severity rate 1955										

1/ Lost time.
2/ No lost time.

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G. Employee's Safety Meeting Report

Date _____

Kennecott Copper Corp.
Ray Mines Division
Employee's Safety Meeting

Department: _____
Shift: _____
Foreman: _____

Present at meeting:

Chairman:		Department head:	
Member:	Occupation:	Member:	Occupation:
Member:	Occupation:	Member:	Occupation:
Member:	Occupation:	Member:	Occupation:
Member:	Occupation:	Member:	Occupation:
Member:	Occupation:	Member:	Occupation:

Suggestion	Suggester	Referred to Supervisor's Safety Committee	Remarks

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H. Safety Engineer's Monthly Report on Safety Suggestions

Date _____

To: _____
Department

Kennecott Copper Corp.
Ray Mines Division

The monthly safety meeting of Supervisors was held: Supervisors in attendance

_____ with _____ _____ _____

_____ acting as chairman. _____ _____

General suggestions	Suggester	Remarks

Departmental suggestions	Suggester	Remarks

For month ending: _____ _____

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